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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/765,522	01/17/2001	Bryant P. Hichwa	OC0101US	9518

22849 7590 05/30/2003

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EXAMINER

STULTZ, JESSICA T

ART UNIT	PAPER NUMBER
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2873

DATE MAILED: 05/30/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/765,522

Applicant(s)

HICHWA ET AL.

Examiner

Jessica T Stultz

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on Amendment A of November 11, 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☐ Claim(s) 1-37 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) 2, 9-11, 14-17, 19, 23-24 and 29-37 is/are allowed.
- 6) ☐ Claim(s) 1, 3-8, 12-13, 18, 20-22, and 25-28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 May 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s) \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Information Disclosure Statement***

For applicant's information, in addition to the considered references set forth in the IDS received June 7, 2001 and the IDS received August 8, 2001, the examiner has also considered the following related applications (as requested by applicant in the IDS cover letters): application numbers 09/765,520, 09/517,649, 09/517,650, 09/517,913 as well as related application 09/764,919.

### ***Claim Rejections - 35 USC § 112***

Claim 1 (and therefore dependent claims 3-5) are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Specifically regarding claim 1, it is unclear as to what the limitations are for the claim based on the phrase "a mirror movably attached" since the mirror is "rotating". For purposes of examination, it is assumed that the phrase be "a mirror rotatably attached".

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 3-8, 12-13, 18, 20-21, 25-26, and 28 are rejected under 35 U.S.C. 102(e) as being anticipated by Fan et al (embodiment 5).

Regarding claim 1, Fan et al (embodiment 5) discloses an optical switch (Column 13, lines 44-45, wherein the switch is "1700", Figure 17) comprising: a mounting substrate (Column 13, wherein the substrate is "1738", Figure 17), a micro-electro-mechanical system die mounted on an edge to the mounting substrate (Column 13, lines 44-49, wherein the MEMS die is the actuator "1710", Figure 17), the MEMS die including a mirror rotatably attached to a base portion of the MEMS die with a flexure hinge (Column 13, lines 44-57, wherein the mirror is "1720", which is rotated by torsion plates "1714 and 1712", Figure 17), the mirror rotating from a first position to a second position in a plane essentially normal to a major surface of the mounting substrate (Column 13, lines 26-57 and Shown in Figure 17); an input port disposed to couple an optical signal to a first output port when the mirror is in the first position and to couple the optical signal to a second output port when the mirror is in the second position (Column 10, lines 25-38, wherein the cells are "930", wherein the switch cell contains the mirror and actuator as disclosed above, the input ports are "910", and the output ports are "940", Figure 9A).

Regarding claim 3, Fan et al (embodiment 5) further discloses that the input port provides the optical signal to the mirror in the second position at an angle of between about 15-45 degrees from a normal of the mirror (Shown in Figure 9A, wherein the input ports are "910" and the mirrors are located on cells "930").

Regarding claim 4, Fan et al (embodiment 5) further discloses that the input port provides the optical signal to the mirror in the second position at an angle of less than about 22.5 degrees from a normal of the mirror (Shown in Figure 9A, wherein the input ports are "910" and the mirrors are located on cells "930").

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Regarding claim 5, Fan et al (embodiment 5) further discloses the mirror having a first mirrored surface and a second mirrored surface (Column 12, lines 19-43, wherein the mirrors "1330 and 1340" have reflective surfaces on both sides, Figure 13), the second mirrored surface being opposite the first mirrored surface (Figure 13), and further comprising a second input port disposed to optically couple a second optical signal to the first output port when the mirror is in the second position (Shown in Figure 13).

Regarding claims 6-8 Fan et al (embodiment 5) discloses a micro-electro-mechanical system ("MEMs") optical cross connect (Column 12, lines 19-43, wherein the cross connect is "1310", Figure 13) comprising: a mounting substrate having a mounting surface (Column 12, lines 19-43, wherein the mounting surface is the bottom surface of "1310", Figure 13); a first MEMs optical switch cell affixed to the mounting surface on an edge of the first optical switch cell and aligned to direct a first optical beam propagating along a beam path from a first optical input to a first optical output when a first optical switching element (Column 12, lines 19-43, wherein the first optical switch cell is mirror "1330", Figure 13), specifically a reflector and more specifically a metallic mirror (Column 12, lines 30-35, Figure 13), of the first MEMs optical switch cell is in the beam path (Shown in Figure 13); and a second MEMs optical switch cell affixed to the mounting surface and aligned to direct the first optical beam from the first optical input to a second optical output when a second optical switching element of the second MEMs optical switch cell is in the beam path (Column 12, lines 19-43, wherein the second optical switch cell is "1340") and the first optical switching element is rotated in a plane essentially normal to the mounting surface out of the beam path (Column 13, lines 45-57, wherein the mirrors "1720" are rotated by actuator, Figure 17).

Regarding claim 12, Fan et al (embodiment 5) further discloses the first MEMs optical switch cell is a latching switch cell configured to maintain the first optical switching element in a first position in a first switch state and in a second position in a second switch state without applied electrical power (Column 13, lines 45-57, wherein the switch "1700" is moved by hinges from a first to second position, Figure 17).

Regarding claim 13, Fan et al (embodiment 5) further discloses the first optical switching element is a two-sided mirror having a first mirrored surface and a second mirrored surface (Column 12, lines 19-43, wherein the mirrors "1330 and 1340" have reflective surfaces on both sides, Figure 13), the first optical beam reflecting off the first mirrored side of the two-sided mirror when the two-sided mirror is in the beam path (Figure 13), and further comprising a second optical input port disposed to provide a second optical signal to the second mirrored side of the two-sided mirror when the two-sided mirror is in the beam path (Shown in Figure 13), the second optical beam being reflected off the second mirrored side to a third optical output wherein the first optical beam optically couples to the third optical output when the first optical element and the second optical element are both switched out of the beam path (Shown in Figure 13).

Regarding claim 18, Fan et al (embodiment 5) discloses a micro-electro-mechanical system ("MEMs") optical cross connect comprising (Column 12, lines 19-43, wherein the cross connect is "1310", Figure 13 and Column 13, lines 45-57, wherein the switch is "1700"): a mounting substrate having a mounting surface (Column 12, lines 19-43, wherein the mounting surface is the bottom surface of "1310", Figure 13); a first latching MEMs optical switch cell affixed to the mounting surface on an edge of the first optical switch cell and aligned to direct a

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first optical beam propagating along a beam path from a first optical input to a first optical output when a first optical switching element (Column 12, lines 19-43, wherein the first optical switch cell is mirror "1330", Figure 13 and Column 13, lines 45-57, wherein the mirror "1720" is moved by hinges from a first to second position, Figure 17), of the first MEMs optical switch cell is latched in an extended position (Shown in Figures 13 and 17); and a second MEMs optical switch cell affixed to the mounting surface and aligned to direct the first optical beam from the first optical input to a second optical output when a second mirror of the second MEMs optical switch cell is latched in a second extended portion (Column 12, lines 19-43, wherein the second optical switch cell is "1340") and the first mirror is rotated in a plane essentially normal to the mounting surface out of the beam path to latch in a retracted position (Column 13, lines 45-57, wherein the mirrors "1720" are rotated by actuator, Figure 17).

Regarding claims 20-21, Fan et al (embodiment 5) discloses an optical cross connect comprising (Column 10, lines 25-38, wherein the optical cross connect is shown in Figure 9A): N optical input ports where N is a first integer (Column 10, lines 29-30, wherein the input ports are "920", Figure 9A); M optical output ports where M is a second integer (Column 10, lines 30-31, wherein the output ports are "940"); and  $N=M$  (Shown in Figure 9A, where there are there are 4 input and 4 output ports); and N times M micro-electro-mechanical system optical switch dice (Column 10, lines 29-30, wherein there are 16 optical switch dice "930", Figure 9A), each of the micro-electro-mechanical switch dice having a drive capable of switching a mirror from a first position to a second position in response to a switching signal provided to the micro-electro-mechanical die (Column 10, lines 25-38, wherein the switching method is disclosed, Column 13, lines 45-57, wherein the cells are moved by a torsion plate by electrostatic force, Figure 17).

Regarding claim 25, Fan et al (embodiment 5) discloses a method for assembling an optical cross connect (Column 12, lines 19-43, wherein the cross connect is "1310", Figure 13), the method comprising: providing a mounting substrate (Column 12, lines 19-43, wherein the mounting surface is the bottom surface of "1310", Figure 13) with a first optical input, a second optical input, a first optical output, and a second optical output (Shown in Figure 13); optically aligning a first micro-electro-mechanical system die with a first optical switching element to direct a first optical beam from the first optical input to the first optical output (Column 12, lines 19-43 and shown in Figure 13); affixing the first micro-electro-mechanical system die to the mounting substrate (Column 12, lines 19-43, wherein the first die is "1330"); optically aligning a second micro-electro-mechanical system die with a second optical switching element to direct a second optical beam from the second optical input to the second optical output (Column 12, lines 19-43 and shown in Figure 13); and affixing the second micro-electro-mechanical system die to the mounting substrate (Column 12, lines 19-43, wherein the second die is "1340").

Regarding claims 26, Fan et al (embodiment 5) further discloses a step, after the affixing the first micro-electro-mechanical system die step, of latching the first optical switching element in a retracted position (Column 13, lines 45-57, wherein the switch "1700" is moved by hinges from a first to second position by an actuator, Figure 17).

Regarding claim 28, Fan et al (embodiment 5) further discloses that the first and second optical switching elements are mirrors (Column 12, lines 30-35, wherein the mirrors are "1330 and 1340", Figure 13) and the steps of selecting the first and second micro-electro-mechanical system die according the first and second mirror criteria (Column 12, lines 30-35, wherein the mirrors are "1330 and 1340", Figure 13).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fan et al (embodiment 5) as disclosed above in claim 20, in view of Fan et al (embodiment 4).

Regarding claim 22, Fan et al (embodiment 5) discloses an optical switch as disclosed above in claim 20, but does not specifically disclose that the drive is a magnetic drive. Fan et al (embodiment 4) teaches of an optical cross connect being driven by a magnetic field so that vertical perm alloy mirrors can be driven (Column 10, lines 1-8). Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made for the optical switch of Fan et al (embodiment 5) to further be driven by a magnetic field so that vertical perm alloy mirrors can be driven.

Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fan et al (embodiment 5) as disclosed above in claims 26, in view of Fan et al (embodiment 3).

Regarding claim 27, Fan et al (embodiment 5) discloses a method for assembling an optical cross connect as disclosed above in claim 26, but does not specifically disclose that the latching step includes applying a mechanical force. Fan et al (embodiment 3) teaches of a method for assembling an optical cross connect being driven by a mechanical force so that the hinged mirrors can be driven (Column 9, lines 64-67). Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made for the method of

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assembling an optical cross connect of Fan et al (embodiment 5) further include an optical cross connect being driven by a mechanical force so that the hinged mirrors can be driven.

***Allowable Subject Matter***

Claims 2, 9-11, 14-17, 19, 23-24, and 29-37 are allowed.

The following is an examiner's statement of reasons for allowance: none of the prior art alone or in combination disclose or teach of the claimed combination of limitations to warrant a rejection under 35 USC 102 or 103.

Specifically regarding independent claims 2, none of the prior art alone or in combination disclose or teach of the claimed optical switch specifically wherein the mirror is formed on a smoothed major crystal plane of a layer of single-crystal silicon and has a reflectivity greater than 96%.

Specifically regarding independent claim 9, none of the prior art alone or in combination disclose or teach of the claimed MEMs optical cross connect specifically wherein at least one of the first and second metallic mirrors has a minimum face dimension of greater than about 400 microns.

Specifically regarding independent claim 14, none of the prior art alone or in combination disclose or teach of the claimed optical switch specifically wherein the first mirrored side and the second mirrored side is formed on a smoothed major crystal plane of a layer of single-crystal silicon and has a reflectivity greater than 96%.

Specifically regarding independent claim 15, none of the prior art alone or in combination disclose or teach of the claimed optical switch specifically wherein first optical input is disposed between 12-57 mm from the first optical output.

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Specifically regarding independent claim 16, none of the prior art alone or in combination disclose or teach of the claimed optical switch specifically wherein first optical input is disposed between 12-57 mm from the first optical output and wherein at least one of the first and second metallic mirrors has a minimum face dimension of greater than about 400 microns.

Specifically regarding independent claim 19, none of the prior art alone or in combination disclose or teach of the claimed MEMs optical cross connect specifically wherein the first metallic mirror has a minimum face dimension of greater than about 400 microns.

Specifically regarding independent claim 23, none of the prior art alone or in combination disclose or teach of the claimed optical cross connect specifically wherein the switching signal has a maximum voltage less than 10 volts.

Specifically regarding independent claim 24, none of the prior art alone or in combination disclose or teach of the claimed optical cross connect specifically wherein the optical cross connect switches 2N optical switch dice in less than about 50mS with an average power consumption of less than 2N/50 Watts.

Specifically regarding independent claims 29 and 33-35 none of the prior art alone or in combination disclose or teach of the claimed method for operating an optical cross connect specifically involving measuring and comparing an impedance of the optical switch to a reference value and providing a switch state output.

Specifically regarding independent claim 37 none of the prior art alone or in combination disclose or teach of the claimed method of manufacturing an optical cross connect wherein the cross is operated in a manner by providing a plurality of electronic control signals to a plurality of micro-electro-mechanical system optical switch dice in the optical cross connect to configure

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the optical cross connect to a selected configuration; removing electrical input to the optical cross connect; and maintaining the selected configuration.

### ***Response to Arguments***

Applicant's arguments with respect to claims 1, 3-8, 12-13, 18, 20-22, and 25-28 have been considered but are moot in view of the new ground(s) of rejection.

Applicant's arguments of Amendment A, filed November 11, 2002, with respect to claims 29-37 have been fully considered and are persuasive. The 102(e) rejection of claims 29-37 has been withdrawn.

### ***Conclusion***

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kruglick and Hussain et al are disclosed as being some similar structure to the claimed invention.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jessica T Stultz whose telephone number is (703) 305-6106. The examiner can normally be reached on M-Th 7:30-5, and alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Georgia Epps can be reached on 703-308-4883. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

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*Jessie Stultz*

Jessica Stultz  
May 14, 2003

*JMS*

JORDAN SCHWARTZ  
PRIMARY EXAMINER